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Plantation Timber on the Island of Hawaii-1965

Robert E. Nelson
and
Nobuo Honda



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State of Hawaii

Foreword

This is the first of a series of reports about plantation timber on the different islands in the State of Hawaii. Summarized here are the results of an inventory of timber in planted forests on the Island of Hawaii. This inventory is a supplement to the initial Forest Survey of the State completed in 1963. The Survey indicated the importance of plantations as a timber resource but provided no details. This bulletin reports: (1) location and acreage of each planted stand, (2) species composition and age of stand, (3) timber volume and quality, and (4) ownership of planted timber.

The study is a cooperative undertaking of the Division of Forestry, Hawaii Department of Land and Natural Resources, and the Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture. It was conducted under the direction of Robert E. Nelson, Chief, Hawaii Forestry Research Center, Pacific Southwest Forest and Range Experiment Station. Nobuo Honda, Forester, Hawaii Division of Forestry, helped develop plans for the plantation inventory and supervised the field work.

Many individuals aided in various phases of the survey. Special acknowledgment is due the field crews: Foresters W. Wong and E. Pung, and assistants S. Kamelamela, A. Chun, J. Hansen, B. Usegawa, J. Ah San, and M. Victorino of the Hawaii Division of Forestry.

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*Large acreages of native forest contain
but small amounts of merchantable timber.*

The first forest inventory in Hawaii showed that the bulk of the forest land and timber resources in the State¹ is on the Island of Hawaii. Of its total land area of 2.6 million acres, some 710,000 acres are commercial forest land with more than 600 million board feet of sawtimber (figs. 1, 2).

A large part of this timber resource is in native forest types. They occupy nearly 700,000 acres of the commercial forest land. The native ohia (*Metrosideros collina*) sawtimber totals about 360 million board feet, and koa (*Acacia koa*)--a more valuable species--totals some 110 million board feet. With sawtimber averaging only about 700 board feet per acre, the native forests are generally poorly stocked.

Planted forests contain a smaller but significant part of the total timber volume. Yields per acre average much greater in planted stands than in native stands. Also, timber in planted forests is generally of higher quality than native timber.

Most readily accessible, this plantation timber is likely to be of greater importance than native timber in any early expansion of milling operations. Therefore, we have made a stand-by-stand inventory to obtain information on plantation timber acreage, volume, quality, and ownership. Data compiled for each plantation stand are summarized in this report, and the section entitled Plantation Timber Resources briefly reviews information about forest plantations in each of four working circles into which the Big Island has been divided.

¹Nelson, Robert E., and Wheeler, Philip R. Forest Resources of Hawaii--1961. Forestry Div., Dep. Land and Natural Resources, State of Hawaii, in cooperation with the Pacific SW. Forest & Range Exp. Sta., Forest Serv., U.S. Dep. Agr. 1963.

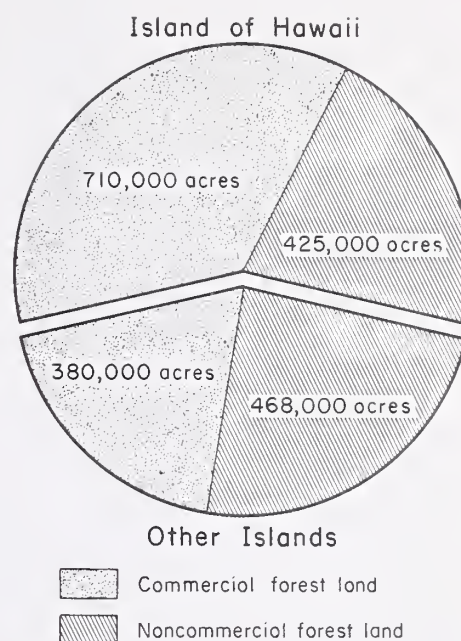


Figure 1.--Commercial and non-commercial forest land acreages on the Island of Hawaii and other islands, 1961.

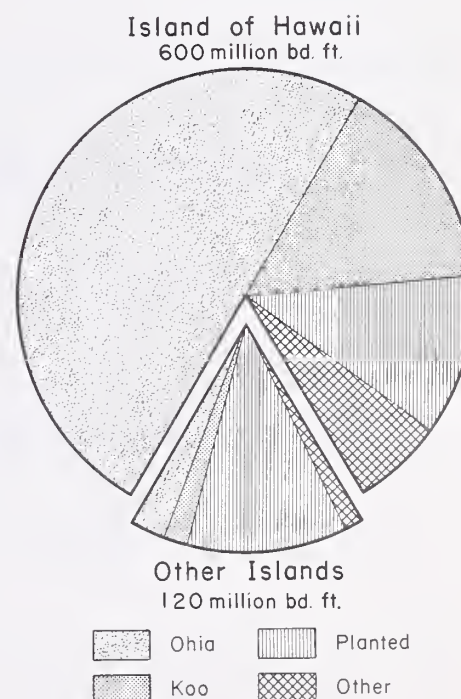


Figure 2.--Sawtimber volumes on the Island of Hawaii and other islands, 1961.

Highlights

Forest Plantation Area

Commercial forest plantations² on the Island of Hawaii total more than 13,300 acres in stands from 2 acres to nearly 250 acres in size. About 7,500 acres of these plantations are sawtimber stands (tables 1, 5, and fig. 3).³ The remainder, some 5,800 acres, are recently planted seedling, sapling, or poletimber stands. In addition to the commercial forest plantations there are about 2,200 acres of plantations of noncommercial types.

Eucalypts are the principal tree species in older plantations. Nearly 6,300 acres of the sawtimber stands are commercial eucalyptus type, of which 4,700 acres are robusta eucalyptus. Only about 900 acres are commercial hardwood types other than eucalyptus. Some 300 acres are commercial conifer types.

Recent plantings have emphasized commercial hardwoods other than eucalyptus (tables 5, 6). There are about 5,700 acres of seedling, sapling, or poletimber stands of these hardwood species; only about 100 acres of commercial eucalyptus types; and less than 50 acres of commercial conifer types.

Most of the forest plantations are in the Hilo-Hamakua Working Circle (table 5). Here are nearly 6,000 acres of commercial sawtimber stands and an additional 4,400 acres of seedling, sapling, or poletimber stands. The other three Working Circles--Kau, Kona, and Kohala combined have about 1,500 acres of planted sawtimber stands and another 1,500 acres of seedling, sapling, or poletimber stands.

²See definitions of terms in Appendix.

³Tables 1 through 20 are in the Appendix.

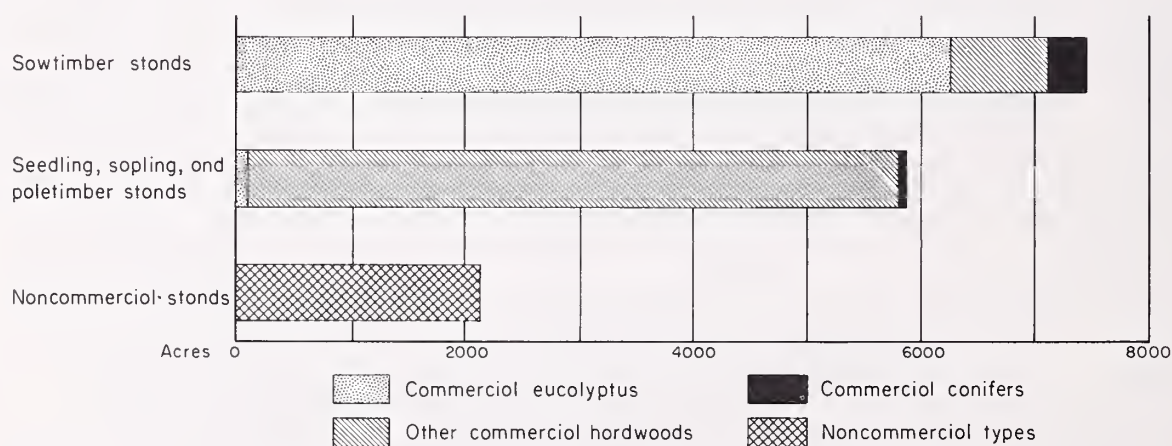
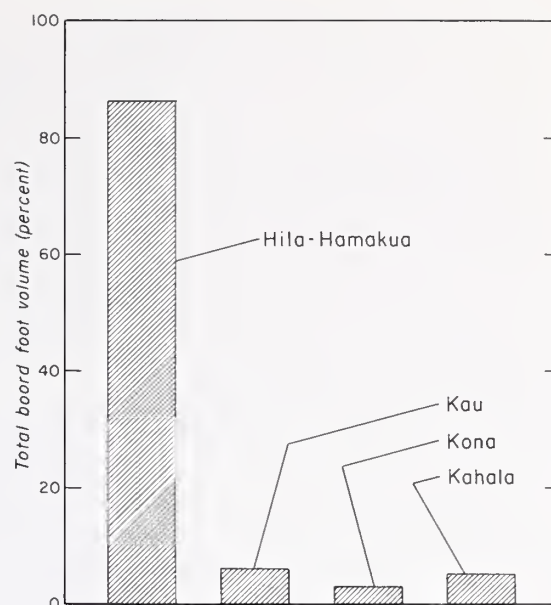


Figure 3.--Acreage of commercial and noncommercial plantation stands, by stand-size class and forest type, Island of Hawaii, 1965.

Figure 4.--Distribution of sawtimber volume in planted stands, by working circles, Island of Hawaii, 1965.



The State owns 65 percent of the acreage of commercial forest plantations (tables 2, 3, 4, 5). This amounts to more than 4,200 acres of sawtimber stands and about 4,500 acres of seedling, sapling, or poletimber stands. Hawaiian Homes⁴ ownership amounts to 7 percent, or about 900 acres of the commercial forest plantations. Nearly 3,700 acres, or 28 percent of the planted commercial forests, are in private ownership.

About 1,200 acres or 54 percent of the noncommercial plantation types, are in State ownership, about 45 percent in private ownership, and only about 1 percent owned by Hawaiian Homes.

Forest Plantation Timber Volume

Planted forests on the Island of Hawaii contain nearly 117 million board feet of sawtimber (tables 7, 8). The volume in robusta eucalyptus sawtimber amounts to 69 percent of the total, or almost 81 million board feet. Sawtimber volume in all other eucalyptus species is 23 percent of the total. Hardwoods other than eucalypts total only 6.9 million board feet. Conifer sawtimber amounts to about 2.7 million board feet, mostly Norfolk-Island-pine.

Nearly two-thirds of the sawtimber volume is in trees 17 to 28 inches d. b. h. (table 10). Only 8 percent of the volume is in trees larger than 28 inches d. b. h.

Sawtimber stands in the Hilo-Hamakua Working Circle make up 86 percent of the total planted sawtimber volume, or about 100 million board feet (fig. 4 and table 8). This includes 71 million board feet of robusta eucalyptus and 24 million feet of other eucalyptus sawtimber. Stands in the Kau Working Circle have about 7 million board feet, the Kona Working Circle nearly 4 million board feet, and the Kohala Working Circle over 5 million board feet.

The State owns 56 percent of the plantation sawtimber: 65 million board feet (table 8 and fig. 5). This total includes about 58 million board

⁴Certain State-owned lands set aside and administered by the Hawaiian Homes Commission for the benefit of the people of Hawaiian ancestry.

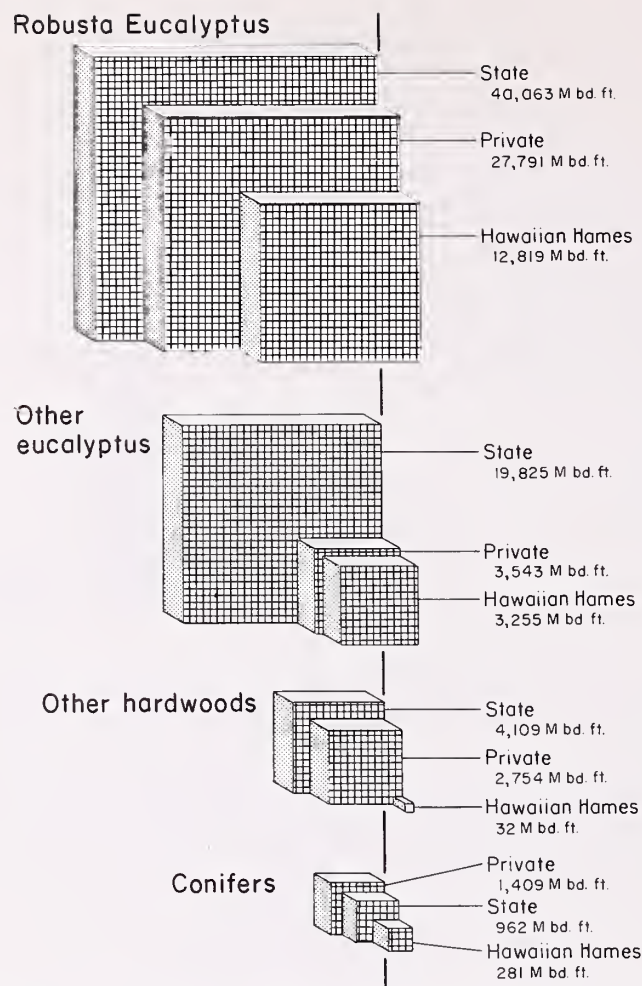


Figure 5.--Sawtimber volume in planted stands by species group and ownership class, Island of Hawaii, 1965.

feet in the Hilo-Hamakua Working Circle, of which 53 million feet are eucalyptus sawtimber. In the Kau, Kona, and Kohala Working Circles, the State owns some 7 million board feet of sawtimber, mostly in Kau.

The total growing stock volume in planted sawtimber stands amounts to about 25 million cubic feet (table 7). Nearly 17 million cubic feet of this volume is robusta eucalyptus. Other eucalypts total more than 5 million cubic feet of growing stock. The volume in other hardwoods is less than 2 million, and in conifers less than 1 million cubic feet.

Poletimber and sapling and seedling stands contain additional volumes of growing stock, but these were not measured.

Wood in cull trees in planted sawtimber stands totals nearly 1.3 million cubic feet (table 9). The 2,200 acres of noncommercial plantations hold an additional, much greater volume of wood in cull trees, but these stands were not measured.

Stand Yields

The average yield of sawtimber in planted sawtimber stands on the Island of Hawaii is about 16,000 board feet per acre. But yields vary widely with stand age, species, site, history and condition of the stand, and other factors. The highest stand average net volume was 79,720 board

feet per acre in a robusta eucalyptus stand. The highest yield based on a single sample location was 95,400 board feet per acre in the same stand; the lowest was 411 board feet per acre.

Yields in planted sawtimber stands in the Hilo-Hamakua Working Circle average about 17,000 board feet per acre. This is much higher than in the Kau and Kona Working Circles but less than in the Kohala Working Circle, which averaged 19,000 board feet per acre.

Age of Stands

Only about 1,400 acres of commercial plantation timber stands are more than 40 years old (table 6). Practically all these older stands are north of Hilo in the Hilo-Hamakua Working Circle. Stands planted from 1926 to 1945 total nearly 6,100 acres. A large part of this acreage was planted between 1935 and 1941 by the Civilian Conservation Corps. Since 1945, more than 5,800 acres of commercial plantations have been established. By far, the greater part of these recent plantings has been done by the State Division of Forestry in the Waiakea Forest Reserve since 1960. Also important are the private plantings since 1957 in the Kona Working Circle, which total nearly 1,400 acres.

The Opportunity for Industrial Development

The Island of Hawaii has a large forest resource--44 percent of the land supports some kind of forest growth. More than 700,000 acres are commercial forest land capable of producing crops of timber. The volume of sawtimber in native forests and plantations totals over 600 million board feet.⁵

Because native forests are generally not well stocked, yields of merchantable timber are low. Nevertheless there has been almost continuous cutting of small amounts of koa and ohia over the past 60 years or more. Given improved processing techniques and equipment, greater technical knowledge about wood properties and characteristics for different uses, and improved market information and marketing methods--greater use of native timber is a likely prospect.

Planted forests have grown rapidly. In contrast to native forests, they now yield high per-acre volumes of sawtimber. The 117 million board feet of sawtimber on 7,500 acres of plantations amounts to about 20 percent of all sawtimber on the entire 700,000 acres of commercial forest land on the Big Island. Timber concentrated in these relatively accessible plantations offers a new opportunity for expanding the local lumber milling industry.

Most of the forestation that produced this new timber resource was not done to grow sawtimber. Trees were planted to control erosion, improve watershed cover, and provide fuelwood. Therefore, species planted were not necessarily selected on the basis of wood quality. Rapid growth was the main criterion. Eucalyptus robusta--a good sawtimber species--was highly favored. But so were several species that presently offer little or no potential for sawtimber, such as bluegum eucalyptus (Eucalyptus globulus), paper-bark (Melaleuca leucadendron), and ironwoods (Casuarina spp.).

⁵Nelson and Wheeler. See footnote 1.

The success of these early plantings shows that timber-production potentials are far greater than might be inferred from data on present volumes. We know that many valuable exotic species are adapted to the different forest sites. And that timber yields can be prodigious. Furthermore, management of native forests can greatly improve the yields and quality of timber. Under management, an average annual sawtimber growth of 1,000 board feet per acre can be expected from well-stocked planted and native forests on good sites.

If only 15 percent of the 700,000 acres of presently little-used and unmanaged commercial forest land were put under management, timber production would eventually amount to more than 100 million board feet annually. This is approximately the amount of wood now used (imported) in Hawaii each year. Three times this amount could be produced if half the commercial forest land on the Big Island were managed for timber crops.

Recent reforestation efforts of the State and of private land owners are trying to capitalize on this potential. Species are being selected with consideration for wood qualities and adaptability to specific sites. Plantings are made in large blocks and they are placing timber species on lands where native forests are of particularly poor quality, often just brush.

Since 1960, about 4,400 acres of land have been reforested by the State Division of Forestry in the Waiakea Forest Reserve of the Hilo Working Circle. About 1,400 acres of private land have been reforested in Kona since 1957. Australian redcedar and tropical ash, both high quality timber species, are the main trees planted. These stands will begin to yield merchantable timber in from 20 to 30 years.

This reforestation effort is being continued and hopefully will be expanded to bring a much larger forest area under management. The amount of reforestation accomplished during the next 10 years will determine in large part the amount of harvestable timber that will be available 30 to 40 years from now.

Plantation Timber Resources

Hilo-Hamakua Working Circle

The Hilo-Hamakua Working Circle makes up the northeast portion of the Island of Hawaii. (See map "Forest Plantations on the Island of Hawaii.") It is bordered on the north by Waipio Valley and on the south by Volcanoes National Park. The summits of Mauna Kea and Mauna Loa and the saddle between them form the western boundary. These boundaries enclose an area about 60 miles long and up to 25 miles wide. This is the windward side of the Big Island, with annual rainfall exceeding 100 inches on most of the land.

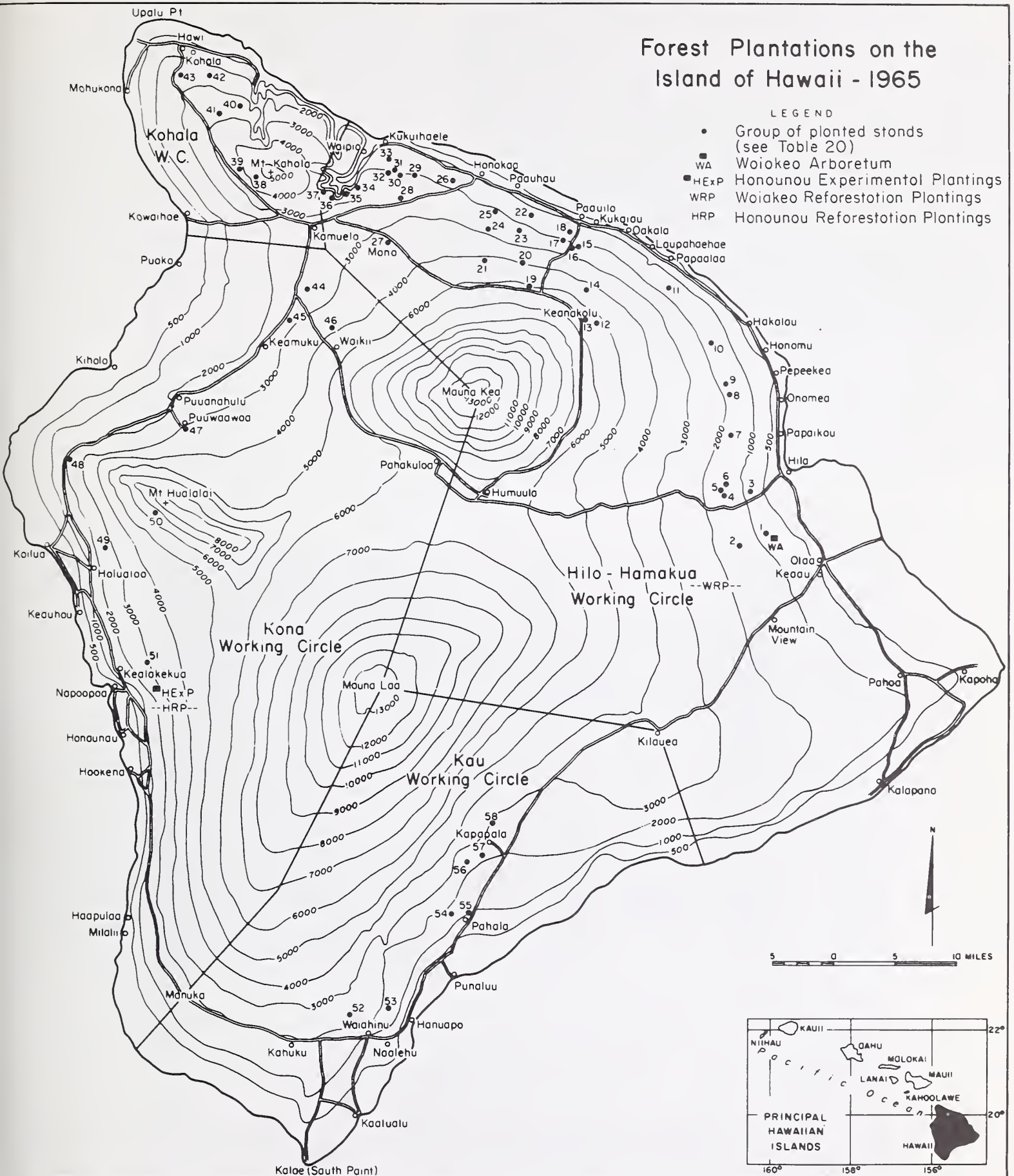
Sugar production is the most important industry in this area. Most lands below about 1,800 feet elevation that are suited to growing sugar cane are used for that purpose. Relatively little acreage is used for other cultivated crops, but fruit, nut, and flower production are important to the local economy.

Cattle graze on a large acreage throughout the area, the major pastures being on the slopes of Mauna Kea outside the forest reserves. Much of the grazed area is forest land.

Forest Plantations on the Island of Hawaii - 1965

LEGEND

- Group of planted stonds (see Table 20)
- WA Woiokeo Arboretum
- HEXP Honounou Experimental Plantings
- WRP Woiokeo Reforestation Plantings
- HRP Honounou Reforestation Plantings





Eucalyptus robusta is the most abundant planted timber. This robusta stand (No. 8038) averages nearly 26,000 board feet of sawtimber per acre.



Tropical ash has not shown consistent high yields like the eucalypts, but the wood is of high value for furniture and cabinetry. In this stand (No. 8166) the net volume averages more than 14,000 board feet per acre.



There are extensive forests in this working circle. The commercial forest land amounts to about 360,000 acres. Most of it is native ohia forest, which has offered little incentive for timber operations in the past. There is also a large acreage of koa forest in this working circle, much of it decadent.

Forest Plantation Area

Within the Hilo-Hamakua Working Circle are about 11,800 acres of forest plantations. They include 6,000 acres of sawtimber stands, 4,400 acres of seedling, sapling, and poletimber stands, and 1,400 acres of non-commercial types (table 1, 5). Many of these planted forests are in the Forest Reserves⁶ adjacent to the upper edges of the cane fields. Also, many stands are in forests outside the Reserves, scattered throughout the general areas of canefields and pastured land.

The bulk of the planted sawtimber stands are within 3 miles of the main highway between Hilo and Waipio Valley. Also, most of the noncommercial plantations are in this area, generally northwest of Hilo. The seedling, sapling, and poletimber stands, on the other hand, are concentrated southwest of Hilo in the Waiakea, Upper Waiakea, and Olaa Forest Reserves.

Forest Types

Robusta eucalyptus type makes up 67 percent of the acreage of planted sawtimber stands (tables 5, 19). *Saligna eucalyptus* and other commercial eucalyptus types comprise about 19 percent of the acreage. Other commercial hardwood species such as tropical ash and silk-oak total about 10 percent, and commercial conifers such as sugi and Norfolk-Island-pine make up the remaining 4 percent of the area.

Most of the 4,400 acres of seedling, sapling, and pole stands are of tropical ash and Australian redcedar. Queensland maple and some eucalypts are also in these stands.

The noncommercial plantation types are mostly bluegum eucalyptus, *Casuarina* spp., and paper-bark, but they include some Monterey cypress.

Timber Volume

Merchantable planted sawtimber totals just over 100 million board feet (table 11). Seventy percent of this is robusta eucalyptus. *Saligna* (13 percent) and other commercial eucalypts (11 percent) make up most of the remainder. Silk-oak, tropical ash, Australian redcedar, and other commercial hardwoods total just over 4 million board feet. The volume in commercial conifers such as Norfolk-Island-pine and sugi totals just under 2 million board feet.

Almost half the sawtimber volume is in trees 19.0 to 28.9 inches d.b.h. (table 11).

Quality

Saligna eucalyptus has the highest quality logs, based on Standard Hardwood Log Grades (table 15).⁷ A remarkable 46 percent of the *saligna* volume is in grade 1 sawlogs, an additional 23 percent in grade 2 logs.

⁶Public and private lands administered by the State for the management and protection of watersheds and other forest values.

⁷Quality of wood as determined by physical properties and mechanical characteristics inherent in species is not a consideration in this classification.

Robusta eucalyptus also has fairly high log quality with 47 percent of the volume in grade 1 and 2 sawlogs. Other commercial eucalypts are comparable to robusta in log quality.

Tropical ash has about 40 percent of total volume in grade 1 and 2 logs. Silk-oak and other hardwoods are of lower log quality, however, with less than 25 percent of the volume in grade 1 and 2 logs.

Conifer species were not log graded.

Ownership

The State of Hawaii is by far the largest owner of forest plantations in the Hilo-Hamakua Working Circle (table 5).⁸ Of the more than 10,000 acres of commercial types tallied, the State owns 76 percent, or nearly 7,900 acres. Additional public ownership is Hawaiian Homes land amounting to just over 900 acres. Only 15 percent, or about 1,550 acres, is in private ownership.

In volume, the State owns a lesser proportion of the timber (table 15) because a substantial area of the State-owned plantations are recently planted seedling, sapling, and poletimber stands. Nevertheless, the State owns about 57 percent of the sawtimber, amounting to nearly 58 million board feet. Hawaiian Homes owns about 16 million board feet, and there are nearly 27 million board feet in private ownership.

Yields

Average stand yields per acre range from a high of nearly 80,000 board feet to less than 750 board feet. Eucalyptus stands in general, and older robusta and saligna stands in particular, have the highest yields. Other hardwoods generally show lowest yields. The average per acre yield for all species in the working circle is about 17,000 board feet.

Timber Cutting Potentials

Plantation timber in the Hilo-Hamakua Working Circle can provide a base for substantial lumber milling operations. A harvest of 5 million board feet of sawlogs per year could be continued for more than 20 years, based on present resources alone. An even larger cut may be possible because timber growth is boosting yields in these plantations.

Assuming a growth of only 500 board feet of sawtimber per acre per year, the nearly 6,000 acres of older plantations would support a sustained annual cut of about 3 million board feet. The acreage now in seedling, sapling, and poletimber stands will yield additional merchantable sawtimber in about 25 years. From then on, the sustained yield from the more than 4,400 acres in these younger stands will amount to more than 2 million board feet annually. The allowable annual cut in these plantations during the first rotation is the sum of annual growth and a portion of the present inventory, assuming the present inventory will be liquidated during the rotation period. Forestation efforts are expected to be continued and even expanded, providing an increasing plantation timber resource base for a lumber milling industry in this working circle.

The large volume of ohia and koa timber in the native forests are an additional resource to support a milling industry. There is little doubt that greater utilization of the native timber resource will come about with improved technology and marketing attendant to a large milling operation.

⁸Ownership of plantation stands is based on interpretation of locations on Tax-Key maps and topographic maps which are often inadequate for precise determinations. Therefore, for a given plantation stand the ownership designation may be in error, although overall ownership statistics are probably not greatly affected by this kind of error.

There is more volume of Norfolk-Island-pine sawtimber than any other conifer species. Here, in stand No. 8029, the average yield is more than 27,000 board feet per acre. →

Australian redcedar (seedlings and saplings in foreground) has been highly favored in recent forestation. Large ohia trees in background were reserved during bulldozing for site preparation. ↓



This 45-year-old Eucalyptus saligna tree, growing on Palani Ranch pasture in Kona, is probably the tallest hardwood tree in the United States. Total height is 235 feet, and diameter at breast height is 48.8 inches. ←



Wind has caused some loss of timber, as in this robusta stand in Kau (stand No. 8216) where net volume averages 9,000 board feet per acre.



Some forest plantations are intermingled with sugar cane fields, as are these in Kau.

Ironwood (dark trunks) and paper-bark are examples of noncommercial plantation types.



Kau Working Circle

The Kau Working Circle lies on the southeast slope of Mauna Loa, southwest of the Volcanoes National Park. It is about 40 miles long and 20 miles wide. Much of the working circle has an annual rainfall of less than 30 inches and thin, rocky soils. There are extensive areas of raw lava flows.

Cattle ranching occupies a large part of the land. Most of the more arid areas, and some forest land, is grazed. Sugar production is probably the most important industry. Most arable land between 1,000 feet and 3,000 feet is used for sugar cane. Crops like macadamia nuts and coffee are important locally, but occupy little acreage.

There are about 120,000 acres of commercial forest land in this working circle, and large areas of noncommercial forest land. Most of the commercial forest land is native ohia forest, which has offered little incentive to exploitation in the past. Most of it lies above the sugar cane plantations.

Forest Plantation Area

This inventory tallied slightly more than 800 acres of planted forests in the Kau Working Circle (tables 1, 5). Nearly 750 acres are sawtimber stands; about 50 acres are noncommercial types. Most of these plantations are at Wood Valley, Middle Moaula, or Kiolakaa, adjacent to sugar cane fields. Very little acreage of the planted forests is in the Forest Reserves.

The area of forest plantations has decreased rapidly since 1955. With the pressure for more acreage of sugar cane, many planted stands have been cut or bulldozed and the land converted to sugar production. There has been only minor salvage of timber during the land clearing operations because of the small size of the island sawmilling industry and problems of timing.

Forest Types

Robusta eucalyptus is the major plantation forest type, occupying nearly 600 acres, or 79 percent of the area of sawtimber stands (tables 5, 19). Saligna eucalyptus accounts for 6 percent of the area, and other commercial eucalypts about 9 percent. Silk-oak and other commercial hardwood plantations occupy less than 50 acres.⁹ There are no commercial conifer type forest stands.

The noncommercial plantation types are mainly ironwood and blue-gum eucalyptus.

Timber Volume

Merchantable planted sawtimber in the Kau Working Circle totals slightly more than 7 million board feet (table 12). Eighty-six percent of this volume, or about 6 million feet, is robusta eucalyptus. The volume in saligna eucalyptus is about one-half million board feet. Other commercial eucalypts and other commercial hardwoods (mainly silk-oak) each total about one-quarter million board feet.

More than 60 percent of the sawtimber volume is in trees 17.0 to 28.9 inches d. b. h.

⁹There are rather extensive areas of naturalized, young silk-oak stands in the working circle.

Quality

Saligna eucalyptus sawtimber is of better quality than that of other species, based on proportion of volume in grades 1 and 2 factory lumber logs. Thirty-nine percent of the *saligna* sawtimber is in grade 1, and 33 percent in grade 2 logs (table 16). Only 20 percent of the *robusta* sawtimber volume is in grade 1 logs, and 17 percent in grade 2 logs; 63 percent is in grades 3 and 4. Other commercial eucalypts are comparable in quality to *robusta*. Only 3 percent of the silk-oak sawtimber is in grade 1 logs, 26 percent is in grade 2, and 71 percent is in grade 3 and 4 logs.

Ownership

The State of Hawaii owns more than half the planted timber in the Kau Working Circle (table 5).¹⁰ This amounts to just over 400 acres of sawtimber stands with about 4.2 million board feet of timber (table 16). The rest of the planted timber, nearly 350 acres of sawtimber stands containing almost 2.9 million board feet, is in private ownership.

Yields

The highest average per-acre volume in a sawtimber stand is in a *robusta* stand containing nearly 36,000 board feet per acre. The lowest yield is in a cutover eucalyptus stand with a residual volume of about 2,600 board feet per acre.

Some wind damage has hit most planted stands in this working circle. Uprooting and stem breakage has reduced volume in about three-fourths of the stands. In some stands this "loss" may amount to 75 percent of the volume.

Timber Cutting Potentials

Plantation timber in the Kau Working Circle is not adequate in itself to sustain full-time operation of even a small mill. And the native timber and timber in young forests of naturalized exotics do not offer much additional resource base for milling operations. There have been no forestation efforts here in recent years, so there are no young planted stands to provide additional timber in the future.

But the existing plantation timber can supplement resources for a milling operation in the Hilo-Hamakua Working Circle. A substantial mill at Hilo, for example, would provide a market for logs, cants, or rough lumber trucked from Kau. A portable mill might be operated temporarily in the Kau Working Circle as a satellite to a larger milling and processing complex in the Hilo-Hamakua Working Circle.

Kona Working Circle

The Kona Working Circle takes in the land on the west slopes of Mauna Kea and Mauna Loa, sweeping down to the ocean. From Manuka on the south, it extends northward to Kamuela. The area is about 60 miles long and 20 miles wide. Topography is steep in parts, often rough and rocky, and there are large areas of recent lava flows. Large parts of the area have an annual rainfall of less than 30 inches.

Cattle and coffee are the major agricultural products in this area. Tourism is a fast-growing business, centered in resort communities like Kailua.

¹⁰See footnote 8.

Commercial forest land totals some 210,000 acres. Most of it lies in a belt extending south from Mt. Hualalai between 1,500 feet and 6,000 feet elevation, where annual rainfall ranges from 30 to 100 inches. The commercial forest land is not well stocked with timber in general, and much of it is grazed, open forest. Ohia is the predominant forest type and has offered little economic incentive for utilization in the past. Koa forests have been exploited and, although koa trees are important components of the forests at higher elevations, koa forests are much less extensive now than formerly, owing to land clearing for cattle production.

Forest Plantation Area

Planted forests in the Kona Working Circle total slightly more than 2,400 acres (tables 1, 5). They include more than 500 acres of sawtimber stands, more than 1,400 acres of seedling, sapling, and pole stands, and nearly 500 acres of noncommercial types. Most of the commercial forest plantations are in the forest reserves, whereas most of the acreage of noncommercial types is outside the reserves.

The Honuaula and North Kona Forest Reserves on the slopes of Mt. Hualalai include about 325 acres, or 63 percent of the acreage of sawtimber stands. The acreage of seedling, sapling, and poletimber stands is concentrated in the Honaunau Forest Reserve. Most of the noncommercial plantations are in the north end of the working circle, where annual rainfall is less than 25 inches.

Forest Types

Sawtimber stands are mainly eucalyptus types and silk-oak type (tables 5, 19): about 200 acres of robusta type, 150 acres of other commercial eucalypts, and 100 acres of silk-oak. There is a very small acreage of other commercial hardwood and conifer types.

Seedling, sapling, and poletimber stands are predominantly of Australian redcedar and tropical ash. Only small acreages of these recent plantings are in eucalypts and conifers.

The noncommercial plantations are mainly of eucalyptus species on very dry sites, unsuited for producing sawtimber crops.

Timber Volume

Sawtimber in forest plantations in the Kona Working Circle totals only 3.9 million board feet (table 13). About 34 percent of this volume, or 1.3 million feet, is robusta eucalyptus. Other eucalypts make up 29 percent. Silk-oak volume totals about 1.1 million board feet. There is an additional small volume of tropical ash and other commercial hardwoods. Commercial conifers, mainly sugi, total nearly one-fourth million board feet.

Two-thirds of the sawtimber volume is in trees less than 19 inches d. b. h.

Quality

Based on log grades, robusta timber is of better quality than other species in this working circle (table 17). Whereas about 38 percent of the robusta sawtimber is in grade 1 and 2 logs, less than 3 percent of the volume of other eucalypts and only 11 percent of the volume of other hardwoods is in grade 1 and 2 logs.

Ownership

Most of the acreage of forest plantations in the Kona Working Circle is in private ownership, but the State owns the bulk of the present

sawtimber stands (table 5).¹¹ The State owns about 350 acres of sawtimber stands with 2.5 million board feet of sawtimber, mostly eucalyptus (table 17). About 160 acres of sawtimber stands with 1.4 million board feet are in private ownership. Most of this is silk-oak.

Seedling, sapling, and poletimber stands are mostly in private ownership, the State owning only about 40 acres out of more than 1,400 acres of these recent plantings.

Yields

The average yield per acre in planted sawtimber stands in the Kona Working Circle is only about 7,500 board feet. The highest average yield is in a stand of sugi with nearly 20,000 board feet per acre. One silk-oak stand averages nearly 11,000 board feet per acre. The low average yield in eucalyptus stands--about 7,000 board feet per acre--is due partly to wind damage. In the North Kona watershed especially, there is a high incidence of windfall because soils are shallow and underlain by pahoehoe.

Timber Cutting Potentials

There is little immediate prospect for any significant milling operations based on plantation timber. Although markets for logs may develop in Hilo or elsewhere, making it feasible to harvest accessible stands, such operations would be short term because of the limited volume. Most sawtimber stands are relatively inaccessible, and it does not seem likely that the limited timber volumes would justify the cost of access roads.

The acreage now in seedling, sapling, and poletimber stands will yield merchantable sawtimber in about 25 years. Also, the private forestation program underway in this working circle is expected to continue. The prospects for milling operations depend on the extent of forestation efforts and the extent to which the native timber can be utilized.

Kohala Working Circle

The Kohala Working Circle covers the northern peninsula of the Big Island, northwest from Kamuela. The smallest of the four working circles on the Island, it is about 20 miles long and 12 miles wide. Sugar and beef are the main products from this area.

There are only 20,000 acres of commercial forest land in this working circle. Most of this is scrubby ohia forest. There are also many areas of noncommercial forest land--part of it brushy kiawe (*Prosopis pallida*) forest in dry areas, part native forest on very steep, rocky sites or swampy areas on Mt. Kohala.

Forest Plantation Area

The total forest plantation area is only 490 acres (table 1, 5). Of this, only 280 acres are commercial types, and 210 acres noncommercial. The greater part of the commercial plantations is in the Kohala forest reserve; most of the noncommercial types are outside the reserve.

Most planted forests are adjacent to canefields or pastures and therefore are relatively easy to reach, but steep topography and wet soil conditions often hinder access.

Forest Types

Robusta eucalyptus is the predominant plantation type, totaling some 140 acres in sawtimber stands (tables 5, 19). There are also small acreages of other commercial eucalyptus types. Other commercial hard-

¹¹See footnote 8.

wood stands total less than 100 acres, and only a few acres are in commercial conifers.

The noncommercial plantings are predominantly ironwood with just a small acreage of paper-bark.

Timber Volume

Plantation sawtimber in this working circle totals 5.2 million board feet (table 14). About 66 percent, or 3.4 million feet of the sawtimber is eucalyptus. Robusta alone totals more than 2.7 million board feet. Other commercial hardwoods, mainly *Molucca albizzia*, make up nearly 1.3 million board feet. Norfolk-Island-pine sawtimber totals nearly one-half million board feet, and there is a very small volume in other conifer species.

Nearly half the volume of sawtimber is in trees 17.0 to 28.9 inches d. b. h.

Quality

It appears that eucalyptus trees are rougher or limbier in general in this than in other working circles. Only about 25 percent of the eucalyptus timber is in grade 1 and 2 logs; 51 percent is in grade 4, or tie and timber logs (table 18). *Molucca albizzia* timber is in larger diameter trees on the average, and 88 percent of the volume is in grade 1 and 2 logs.

Ownership

Nearly 80 percent of the commercial forest plantation acreage is privately owned (table 5).¹² This amounts to nearly 220 acres with 4.4 million feet of sawtimber (table 18). State and Hawaiian Homes ownership combined amounts to about 60 acres, with some three-fourths million board feet of sawtimber.

Most of the noncommercial plantation acreage is also privately owned, but a small acreage is in Hawaiian Homes ownership.

Yields

The average sawtimber yield in this working circle is slightly more than 19,000 board feet per acre. The highest average per-acre volume is in a small stand of *Eucalyptus citriodora*, yielding over 35,000 board feet per acre.

Timber Cutting Potentials

The Kohala Working Circle has too little plantation timber to support full-time operation of even a small sawmill. The sawtimber in native forests is in such small amounts and so scattered that it is unimportant.

The present plantation timber can, however, provide a supplemental supply for a mill in the Hilo-Hamakua Working Circle. A substantial operation in that working circle, for example, might provide a profitable market for logs from the more accessible high-quality timber stands.

¹²See footnote 8.

Appendix

Definitions

Forest land: Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover and not currently developed for other use; and land supporting shrubs, the crowns covering more than 50 percent of the ground.

Commercial forest land: Forest land that is producing or can produce crops of industrial wood (usually sawtimber) and is not withdrawn from timber use.

Noncommercial forest land: (a) Productive-reserved forest land withdrawn from timber use through statute or administrative regulation, and (b) unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions.

Forest plantation: Planted forests in which at least 10 percent of the growing space is occupied by planted commercial species (usually exotic), regardless of native species predominance.

Commercial forest plantation: A plantation of commercial tree species on commercial forest land.

Noncommercial forest plantation: A plantation of noncommercial tree species or of commercial tree species planted on noncommercial forest land.

Commercial tree species: Tree species suitable for industrial wood products. Species suited only for fuelwood or fence posts are excluded. The following were tallied on plots:

<u>Scientific Name</u>	<u>Common Name</u>
<u>Acacia koa</u>	koa
<u>Albizia falcata</u>	Molucca albizzia
<u>Alnus nepalensis</u>	Nepal alder
<u>Araucaria excelsa</u>	Norfolk-Island-pine
<u>Chamaecyparis lawsoniana</u>	Port-Orford-cedar
<u>Cryptomeria japonica</u>	sugi
<u>Eucalyptus citriodora</u>	lemon eucalyptus
<u>Eucalyptus deanei</u>	Deane eucalyptus
<u>Eucalyptus maideni</u>	Maiden-gum eucalyptus
<u>Eucalyptus microcorys</u>	tallowwood eucalyptus
<u>Eucalyptus paniculata</u>	gray ironbark eucalyptus
<u>Eucalyptus pilularis</u>	blackbutt eucalyptus
<u>Eucalyptus resinifera</u>	kinogum eucalyptus
<u>Eucalyptus robusta</u>	robusta eucalyptus
<u>Eucalyptus saligna</u>	saligna eucalyptus
<u>Eucalyptus spp.</u>	unidentified eucalyptus
<u>Fraxinus uhdei</u>	tropical ash
<u>Grevillea robusta</u>	silk-oak
<u>Metrosideros collina</u>	ohia

<u>Scientific Name</u>	<u>Common Name</u>
<u>Pithecellobium saman</u>	monkey-pod
<u>Sequoia sempervirens</u>	redwood
<u>Syncarpia glomulifera</u>	turpentine-tree
<u>Taxodium distichum</u>	baldcypress
<u>Terminalia myriocarpa</u>	jhalna
<u>Thuja plicata</u>	western redcedar
<u>Toona ciliata</u> var. <u>australis</u>	Australian redcedar (toon)
<u>Tristania conferta</u>	brushbox

Noncommercial tree species: Tree species not now considered suitable for industrial products. The following were tallied on plots:

<u>Scientific Name</u>	<u>Common Name</u>
<u>Aleurites moluccana</u>	kukui
<u>Casuarina</u> spp.	ironwoods
<u>Cheirodendron</u> sp.	'olapa
<u>Cupressus macrocarpa</u>	Monterey cypress
<u>Delonix regia</u>	royal poinciana
<u>Eucalyptus globulus</u>	bluegum eucalyptus
<u>Eucalyptus</u> sp.	unidentified eucalyptus
<u>Ficus</u> spp.	figs
<u>Jacaranda minosifolia</u>	jacaranda
<u>Melaleuca leucadendron</u>	paper-bark
<u>Myoporum sandwicense</u>	naio
<u>Straussia</u> sp.	kopiko

Hardwoods: Dicotyledonous trees, usually broadleaved.

Softwoods: Coniferous trees, usually evergreen, having needle or scale-like leaves.

Forest types: Planted stands which are predominantly of a single species and in which no other species makes up 25 percent or more of the stand, are designated by the single species such as robusta eucalyptus type or tropical ash type. Otherwise they are designated:

Commercial eucalyptus type: Planted stands predominantly of eucalyptus species, in which other hardwoods or conifers comprise less than 25 percent of the stand.

Commercial hardwood type: Planted stands predominantly of hardwoods other than the eucalypts in which conifers or eucalypts comprise less than 25 percent of the stand.

Commercial conifer type: Planted forests predominantly of conifers (e. g. Norfolk-Island-pine, sugi, pines, and redwood) in which eucalypts or other hardwoods comprise less than 25 percent of the stand.

Class of Timber

Growing stock: Live trees of good form and vigor and of species suited for industrial wood (commercial species).

Sawtimber trees: Live trees of commercial species of at least 11.0 inches diameter breast height which contain a butt half-log or a log which meets the specifications of standard lumber, or tie and timber log grades.

Poletimber trees: Live trees of commercial species between 5.0 and 10.9 inches d.b.h., having soundness and form necessary to develop into sawtimber trees.

Saplings and seedlings: Live trees of commercial species between 1.0 and 4.9 inches d.b.h. and less than 1 inch, respectively, which show promise of becoming sawtimber trees.

Sound cull trees: Live trees 1 inch d.b.h. or larger which do not qualify as growing stock because of species (noncommercial species), poor form, or excessive limbs.

Rotten cull trees: Live trees 1 inch d.b.h. or larger which are not growing stock or sound cull because of excessive rot.

Merchantable sawtimber: Wood in trees defined as sawtimber trees.

Volume

International 1/4-inch kerf log rule: A formula rule for estimating the board-foot volume of logs, by 4-foot log sections, V equals $0.905 (0.22D^2 - 0.71D)$.

Sawtimber volume: The net volume of the saw-log portion of sawtimber trees, in board feet, International 1/4-inch rule.

Saw-log portion: That part of the main bole of sawtimber trees between the stump and the merchantable top.

Merchantable top: The point on the bole above which a merchantable sawlog cannot be obtained; i. e., the point where the main stem divides into limbs or is less than 8 inches diameter inside bark.

Growing stock volume: Volume in cubic feet of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum top diameter inside bark (d.i.b.) of 4.0 inches, or to the point where the main stem divides into limbs.

All timber volume: Volume in cubic feet of sound wood in the bole of growing stock and cull trees 5.0 inches d.b.h. or larger, from stump to a minimum top diameter inside bark (d.i.b.) of 4.0 inches.

Stand-Size Classes

Sawtimber stands: Stands at least 10 percent stocked with growing-stock trees, half or more in sawtimber and poletimber trees, and sawtimber stocking at least equal to poletimber.

Poletimber stands: Stands failing to qualify as sawtimber but at least 10 percent stocked with growing stock trees, at least half poletimber.

Sapling and seedling stands: Stands not qualifying as sawtimber or poletimber, but at least 10 percent stocked with growing stock.

Nonstocked: Commercial forest lands less than 10 percent stocked with growing stock trees.

Miscellaneous

Diameter breast height (d.b.h.): Tree diameter in inches, outside bark, measured at 4-1/2 feet above the ground for normal trees, and 18 inches above the stilt or swell for abnormal trees.

Industrial wood: Commercial roundwood products, such as sawlogs, veneer logs, and pulpwood. Fuelwood and fence posts are excluded.

Log grades: A classification of logs based on external characteristics as indicators of quality or value. Grade 1 is the highest quality, grade 2 intermediate, and grade 3 the lowest quality of standard hardwood factory lumber logs.¹ Grade 4 logs are suitable for ties and timbers.

Timber quality: Based on log grades unless stated otherwise. Characteristics of wood such as density, strength, color, and shrinkage, are also measures of quality. However, these are usually inherent in a species.

Working Circle: A term of convenience understood by timber operators and foresters as referring to a relatively large land area for management, administrative, or economic purposes.

Inventory Procedure

Area and volume statistics presented in this report were developed plantation stand by plantation stand. First, individual forest plantations of 2 acres or more were identified and delineated on aerial photographs through stereoscopic study. Each plantation was given a stand number and classified as to type and stand-size group. The area of each plantation was measured on the photograph. Ownership and stand age were determined from maps and other records. Field examination of each plantation allowed for correcting delineations, classifications, and acreages.

Next, timber-volume plots were located on the ground in each commercial forest plantation of 5 acres and larger having sawtimber trees. The sample plot locations were selected at random from a grid of points overlaid on the aerial photograph. Two or more sample locations, depending on stand acreage and variability, were selected in each stand. At each location, tree measurements were made from which timber volume and quality could

¹U.S. Forest Products Laboratory. Hardwood log grades for standard lumber--proposals and results. U.S. Forest Serv. Forest Prod. Lab. Rep. 1737, 15 pp., illus. 1953.

be computed and expanded. Detailed measurements were made on a "main" plot at each location, supplemented by additional but less detailed data on two "satellite" plots. All plots were variable plots with a basal area factor of 20.

Finally, the data were processed through a specially prepared electronic computer program. Tree measurements were converted to meaningful volume units on a per-acre basis, averaged for the plots in a stand, and expanded for the acreage of the stand. The computer output consisted of tabular data for each stand and summaries of stand data by forest reserves. Volumetric data for stands 2 to 4 acres in size were extrapolated from closely similar measured stands.

The accuracy goal for this inventory was ± 20 percent per 5 million net board feet of sawtimber in a stand, at the level of one standard error. The reliability of estimates for each forest reserve are shown below in terms of sampling errors to which the estimates are liable, two chances out of three.

<u>Forest Reserve</u>	<u>Total volume</u> (thousand bd. ft.)	<u>Sampling error</u> (percent)
Hamakua	52,885	7.5
Hilo	24,507	9.6
Honuaula	1,255	34.6
Kau	1,321	15.0
Kohala	8,227	5.6
Manowaialee	2,048	19.0
North Kona Watershed	1,108	9.3
Waiakea	1,109	3.7
Outside Forest Reserve	22,240	7.8

Tables

Table 1.--Area of forest plantations for all ownerships by forest type, working circle, and forest reserve, Island of Hawaii, 1965

Working circle and forest reserve	Forest type						Acres					
	Commercial : eucalypts	Commercial : hardwoods	Other : commercial	Other : commercial	Other : commercial	Other : commercial	Commercial : conifers	Commercial : types	Commercial : noncommercial	Commercial : types	Commercial : types	Total : all types
Hilo-Hamakua												
Hamakua	2,152	322	69	2,543	69	2,612						
Hilo	1,387	104	110	1,601	14	1,615						
Kohala	287	52	88	427	--	427						
Manowaialee	102	88	--	190	21	211						
Waiakea	133	851	--	984	--	984						
Upper Waiakea	--	2,233	--	2,233	--	2,233						
Olaa	12	1,178	--	1,190	--	1,190						
Outside Reserve	999	166	33	1,198	1,294	2,492						
Total	5,072	4,994	300	10,366	1,398	11,764						
Kau												
Kau	148	14	--	162	--	162						
Outside Reserve	554	37	--	591	63	654						
Total	702	51	--	753	63	816						
Kona												
Kahaluu	2	9	--	11	--	11						
Honaunau	67	1,312	--	1,379	--	1,379						
Honuaula	143	25	49	217	--	217						
North Kona Watershed	148	--	--	148	--	148						
Outside Reserve	63	116	9	188	513	701						
Total	423	1,462	58	1,943	513	2,456						
Kohala												
Kohala (West)	139	75	21	235	16	251						
Outside Reserve	31	9	5	45	194	239						
Total	170	84	26	280	210	490						
Total all working circles	6,367	6,591	384	13,342	2,184	15,526						

Table 2.--Area of forest plantations in State ownership by forest type, working circle, and forest reserve, Island of Hawaii, 1965

Working circle and forest reserve	Forest type						Acres					
	: Commercial : eucalypts	: Other : hardwoods	: Commercial : conifers	: Commercial : types	: noncommercial : types	: Total : all types	: Commercial : conifers	: Commercial : types	: noncommercial : types	: Total : all types	: Commercial : conifers	: Commercial : types
Hilo-Hamakua												
Hamakua	1,121	303	--	1,424	63	1,487						
Hilo	1,114	104	110	1,328	--	1,328						
Kohala (East)	100	52	86	238	--	238						
Manowaialee	76	88	--	164	--	164						
Waiakea	133	851	--	984	--	984						
Upper Waiakea	--	2,233	--	2,233	--	2,233						
Olaa	12	1,178	--	1,190	--	1,190						
Outside Reserve	199	139	--	338	1,049	1,387						
Total	2,755	4,948	196	7,899	1,112	9,011						
Kau												
Kau	148	14	--	162	--	162						
Outside Reserve	251	--	--	251	38	289						
Total	399	14	--	413	38	451						
Kona												
Honuaula	143	25	49	217	--	217						
North Kona Watershed	148	--	--	148	--	148						
Outside Reserve	6	--	--	6	2	8						
Total	297	25	49	371	2	373						
Kohala												
Kohala (West)	37	--	--	37	--	37						
Outside Reserve	--	--	--	--	--	--						
Total	37	--	--	37	--	37						
Total all working circles	3,488	4,987	245	8,720	1,152	9,872						

Table 3.--Area of forest plantations in Hawaiian Homes ownership by forest type, working circle, and forest reserve, Island of Hawaii, 1965

Working circle and forest reserve	Forest type				Acres			
	Commercial : eucalypts	Commercial : hardwoods	Commercial : conifers	Commercial : types	Commercial : noncommercial : types	Total : commercial : types	Total : noncommercial : types	Total : all types
Hilo-Hamakua								
Hamakua	840	--	36	876	--	876	--	876
Kohala (East)	11	--	2	13	--	13	--	13
Outside Reserve	15	12	3	30	16	30	16	46
Total	866	12	41	919	16	919	16	935
Kau	--	--	--	--	--	--	--	--
Kona	--	--	--	--	--	--	--	--
Kohala								
Kohala (West)	18	--	8	26	16	26	16	42
Outside Reserve	--	--	--	--	--	--	--	--
Total	18	--	8	26	16	26	16	42
Total all working circles	884	12	49	945	32	945	32	977

Table 4.--Area of forest plantations in private ownership by forest type, working circle, and forest reserve, Island of Hawaii, 1965

Working circle and forest reserve	Forest type						Acres		
	Commercial : eucalypts	Commercial : hardwoods	Commercial : conifers	Commercial : types	Commercial : noncommercial : types	Total : all types			
Hilo-Hamakua									
Hamakua	191	19	33	243	6	249			
Hilo	273	--	--	273	14	287			
Kohala (East)	176	--	--	176	--	176			
Manowaialee	26	--	--	26	21	47			
Outside Reserve	785	15	30	830	229	1,059			
Total	1,451	34	63	1,548	270	1,818			
Kau									
Kau	--	--	--	--	--	--			
Outside Reserve	303	37	--	340	25	365			
Total	303	37	--	340	25	365			
Kona									
Kahaluu	2	9	--	11	--	11			
Honaunau	67	1,312	--	1,379	--	1,379			
Outside Reserve	57	116	9	182	511	693			
Total	126	1,437	9	1,572	511	2,083			
Kohala									
Kohala (West)	84	75	13	172	--	172			
Outside Reserve	31	9	5	45	194	239			
Total	115	84	18	217	194	411			
Total all working circles	1,995	1,592	90	3,677	1,000	4,677			

Table 5.--Area of commercial forest plantations by forest type, ownership class, stand-size class, and working circle, Island of Hawaii, 1965

Working circle and stand-size class	Forest type and ownership class											
	Commercial eucalypts						Other commercial hardwoods					
	:Hawaiian:	:Homes:	:Private:	:State:	:Homes:	:Private:	:Hawaiian:	:Homes:	:Private:	:State:	:Homes:	:Private:
	Acres						Acres					
Hilo-Hamakua												
Sawtimber	2,720	866	1,451	5,037	558	12	34	604	196	39	60	295
Pole timber	--	--	--	--	--	--	--	--	--	--	3	3
Seedling and sapling	35	--	--	35	4,390	--	--	4,390	196	2	--	2
All classes	2,755	866	1,451	5,072	4,948	12	34	4,994	196	41	63	300
												10,366
Kau												
Sawtimber	399	--	303	702	8	--	37	45	--	--	--	--
Pole timber	--	--	--	--	6	--	--	6	--	--	--	--
Seedling and sapling	--	--	--	--	--	--	--	--	--	--	--	--
All classes	399	--	303	702	14	--	37	51	--	--	--	753
Kona												
Sawtimber	297	--	57	354	25	--	116	141	8	--	9	17
Pole timber	--	--	--	--	--	--	--	--	41	--	--	41
Seedling and sapling	--	--	69	69	--	--	1,321	1,321	--	--	--	--
All classes	297	--	126	423	25	--	1,437	1,462	49	--	9	58
												1,943
Kohala												
Sawtimber	37	18	115	170	--	--	75	75	--	8	18	26
Pole timber	--	--	--	--	--	--	9	9	--	--	--	--
Seedling and sapling	--	--	--	--	--	--	--	--	--	--	--	--
All classes	37	18	115	170	--	--	84	84	--	8	18	26
												280
All Working Circles												
Sawtimber	3,453	884	1,926	6,263	613	12	240	865	204	47	87	338
Pole timber	--	--	--	--	6	--	9	15	41	--	3	44
Seedling and sapling	35	--	69	104	4,390	--	1,321	5,711	--	2	--	2
All classes	3,488	884	1,995	6,367	4,987	12	1,592	6,591	245	49	90	384
												13,342

Table 6.--Area of forest plantations by forest type, period planted, and working circle,
Island of Hawaii, 1965

Working circle and forest type	Period of planting						Total
	1906-1915	1916-1925	1926-1935	1936-1945	1946-1955	1956-1965	
----- Acres -----							
Hilo-Hamakua							
Robusta eucalyptus	39	970	2,930	70	--	--	4,009
Other eucalypts	11	263	743	11	--	35	1,063
Other hardwoods	--	94	510	--	--	4,390	4,994
Commercial conifers	--	--	295	3	2	--	300
Noncommercial types	77	1,148	163	10	--	--	1,398
Total	127	2,475	4,641	94	2	4,425	11,764
Kau							
Robusta eucalyptus	--	4	544	39	--	--	587
Other eucalypts	--	--	115	--	--	--	115
Other hardwoods	--	4	47	--	--	--	51
Commercial conifers	--	--	--	--	--	--	--
Noncommercial types	--	21	42	--	--	--	63
Total	--	29	748	39	--	--	816
Kona							
Robusta eucalyptus	--	3	200	--	--	--	203
Other eucalypts	--	6	145	--	--	69	220
Other hardwoods	--	--	141	--	--	1,321	1,462
Commercial conifers	--	--	17	41	--	--	58
Noncommercial types	--	19	432	62	--	--	513
Total	--	28	935	103	--	1,390	2,456
Kohala							
Robusta eucalyptus	--	--	134	7	--	--	141
Other eucalypts	--	--	27	2	--	--	29
Other hardwoods	--	59	25	--	--	--	84
Commercial conifers	--	13	13	--	--	--	26
Noncommercial types	--	--	210	--	--	--	210
Total	--	72	409	9	--	--	490
Total, all working circles	127	2,604	6,733	245	2	5,815	15,526

Table 7.--Volume of growing stock and sawtimber, by species,
in planted sawtimber stands, Island of Hawaii, 1965

Species	Growing	
	stock	Sawtimber
	<u>Thousand</u> <u>cubic feet</u>	<u>Thousand</u> <u>board feet</u>
Australian redcedar	23	88
Blackbutt eucalyptus	33	175
Brushbox	297	1,270
Deane eucalyptus	30	90
Eucalyptus spp.	1,802	7,287
Gray ironbark eucalyptus	18	96
Jhalna	98	224
Kinogum eucalyptus	286	1,282
Koa	3	14
Lemon eucalyptus	142	627
Maiden-gum eucalyptus	67	249
Molucca albizzia	221	1,154
Nepal alder	135	497
Norfolk-Island-pine	274	1,359
Ohia	132	394
Port-Orford-cedar	5	--
Redwood	20	94
Robusta eucalyptus	16,830	80,673
Saligna eucalyptus	2,415	13,895
Silk-oak	844	3,191
Sugi	619	1,181
Tallowwood eucalyptus	195	991
Tropical ash	464	1,331
Turpentine-tree	134	661
Western redcedar	20	20
Island total	25,107	116,843

Table 8.--Volume of growing stock and sawtimber in planted sawtimber stands by working circle, ownership class, ^{1/} and species group, Island of Hawaii, 1965
(in thousands of feet)

Working circle and species group	State		Hawaiian Homes		Private		All ownerships	
	Growing : stock	Sawtimber : Bd.ft. 2/	Growing : stock	Sawtimber : Bd.ft. 2/	Growing : stock	Sawtimber : Bd.ft. 2/	Growing : stock	Sawtimber : Bd.ft. 2/
	Cu.ft.		Cu.ft.		Cu.ft.		Cu.ft.	
Hilo-Hamakua								
Robusta eucalyptus	7,260	35,117	2,699	12,558	4,640	22,836	14,599	70,511
Saligna eucalyptus	1,538	9,212	467	2,706	276	1,421	2,281	13,339
Other eucalypts ^{3/}	1,927	8,902	207	549	323	1,258	2,457	10,709
Silk-oak	479	1,873	9	--	--	--	488	1,873
Tropical ash	221	1,018	6	9	196	209	423	1,236
Other hardwoods ^{4/}	252	923	47	23	44	149	343	1,095
Norfolk-Island-pine	--	--	--	--	186	899	186	899
Other conifers ^{5/}	422	797	131	180	40	45	593	1,022
Total	12,099	57,842	3,566	16,025	5,705	26,817	21,370	100,684
Kau								
Robusta eucalyptus	755	3,444	--	--	569	2,664	1,324	6,108
Saligna eucalyptus	129	530	--	--	4	22	133	552
Other eucalypts ^{3/}	28	121	--	--	18	80	46	201
Silk-oak	32	97	--	--	30	127	62	224
Other hardwoods ^{4/}	3	4	--	--	--	--	3	4
Norfolk-Island-pine	2	--	--	--	--	--	2	--
Total	949	4,196	--	--	621	2,893	1,570	7,089
Kona								
Robusta eucalyptus	219	1,124	--	--	41	184	260	1,308
Other eucalypts ^{3/}	325	1,024	--	--	25	105	350	1,129
Silk-oak	26	98	--	--	268	996	294	1,094
Tropical ash	37	86	--	--	4	9	41	95
Other hardwoods ^{4/}	2	10	--	--	1	1	3	11
Commercial conifers ^{5/}	39	165	--	--	20	66	59	231
Total	648	2,507	--	--	359	1,361	1,007	3,868
Kohala								
Robusta eucalyptus	116	378	60	261	471	2,107	647	2,746
Saligna eucalyptus	--	--	--	--	1	4	1	4
Other eucalypts ^{3/}	10	36	--	--	141	653	151	689
Other hardwoods ^{4/}	--	--	--	--	264	1,263	264	1,263
Norfolk-Island-pine	--	--	12	69	73	391	85	460
Other conifers ^{5/}	--	--	10	32	2	8	12	40
Total	126	414	82	362	952	4,426	1,160	5,202
Total, all working circles	13,822	64,959	3,648	16,387	7,637	35,497	25,107	116,843

^{1/} Ownership of plantation stands is based on interpretation of locations on Tax-Key maps and topographic maps which are often inadequate for precise determinations. Therefore, for a given plantation stand the ownership designation may be in error, although overall ownership statistics are probably not greatly affected by this kind of error.

^{2/} International 1/4-inch rule.

^{3/} Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

^{4/} Includes ohia, koa, Molluca albizzia, Jhalna, Australian redcedar, and Nepal alder.

^{5/} Includes sugi, western redcedar, Port-Orford-cedar, baldcypress, and redwood.

Table 9.--Volume of cull trees in planted sawtimber stands
by working circles and species groups,
Island of Hawaii, 1965

Species group	Volume by working circle				All
	Hilo-Hamakua :	Kau :	Kona :	Kohala :	
	----- Thousand cubic feet -----				
Robusta eucalyptus	252	73	16	21	362
Saligna eucalyptus	9	4	--	--	13
Other commercial eucalypts ^{1/}	56	2	16	2	76
Silk-oak	8	3	19	--	30
Tropical ash	4	--	12	--	16
Other commercial hardwoods ^{2/}	36	1	5	1	43
Norfolk-Island-pine	1	--	--	1	2
Other commercial conifers ^{3/}	60	--	2	1	63
Noncommercial species ^{4/}	632	16	20	8	676
Total	1,058	99	90	34	1,281

1/ Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

2/ Includes ohia, koa, Molucca albizzia, jhalna, Australian redcedar, and Nepal alder.

3/ Includes sugi, western redcedar, Port-Orford-cedar, baldcypress, and redwood.

4/ Includes Casuarina spp., paperbark, bluegum eucalyptus, kukui, kopiko, Ficus spp.,
naio, jacaranda, and poinciana.

Table 10.--Volume of sawtimber and growing stock in planted sawtimber stands
by species group and tree diameter class, Island of Hawaii, 1965

		Tree diameter class (inches at breast height)															
:	:	5.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	25.0-	27.0-	29.0-	31.0-	33.0-	35.0-	37.0-	39.0-
:	:	10.9	12.9	14.9	16.9	18.9	20.9	22.9	24.9	26.9	28.9	30.9	32.9	34.9	36.9	38.9	40.9
Species group	classes :	----- Thousand board feet ^{1/} -----															
Robusta eucalyptus	80,673	--	3,603	7,368	10,993	12,958	39,386	5,916	449								
Saligna eucalyptus	13,895	--	336	583	1,071	1,673	8,921	1,279	32								
Other eucalypts ^{2/}	12,728	--	903	1,786	2,162	2,402	4,853	606	16								
Silk-oak	3,191	--	491	823	805	543	529	--	--								
Tropical ash	1,331	--	56	124	202	228	540	181	--								
Other hardwoods ^{3/}	2,373	--	154	284	182	301	714	574	164								
Norfolk-Island-pine	1,359	--	93	263	373	317	285	28	--								
Other conifers ^{4/}	1,293	--	280	345	243	191	234	--	--								
Total	116,843	--	5,916	11,576	16,031	18,613	55,462	8,584	661								

		Thousand cubic feet															
:	:	5.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	25.0-	27.0-	29.0-	31.0-	33.0-	35.0-	37.0-	39.0-
:	:	10.9	12.9	14.9	16.9	18.9	20.9	22.9	24.9	26.9	28.9	30.9	32.9	34.9	36.9	38.9	40.9
Species group	classes :	----- Thousand cubic feet -----															
Robusta eucalyptus	16,830	893	1,289	1,884	2,309	2,464	6,955	967	69								
Saligna eucalyptus	2,415	82	117	143	199	286	1,386	196	6								
Other eucalypts ^{2/}	3,004	300	334	457	457	462	884	103	7								
Silk-oak	844	126	162	187	161	104	104	--	--								
Tropical ash	464	37	159	32	43	47	109	37	--								
Other hardwoods ^{3/}	613	135	45	64	37	62	137	103	30								
Norfolk-Island-pine	273	21	27	52	66	55	47	5	--								
Other conifers ^{4/}	664	324	114	92	54	37	43	--	--								
Total	25,107	1,918	2,247	2,911	3,326	3,517	9,665	1,411	112								

1/ International 1/4-inch rule.

2/ Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

3/ Includes ohia, koa, Molucca albizzia, jhalna, Australian redcedar, and Nepal alder.

4/ Includes sugi, western redcedar, Port-Orford-cedar, and redwood.

Table 11.--Volume of sawtimber and growing stock in planted sawtimber stands by species group and tree diameter class in Hilo-Hamakua Working Circle, Island of Hawaii, 1965

Species group	Tree diameter class (inches at breast height)										
	All	5.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	25.0-	plus
: classes : 10.9 : 12.9 : 14.9 : 16.9 : 18.9 : 20.9 : 22.9 : 24.9 : 26.9 : 28.9 : 30.9											
----- Thousand board feet ^{1/} -----											
Robusta eucalyptus	70,511	--	3,092	5,884	9,288	11,071	35,357	5,377	442		
Saligna eucalyptus	13,339	--	317	558	1,051	1,639	8,560	1,182	32		
Other eucalypts ^{2/}	10,709	--	716	1,414	1,856	2,023	4,112	579	9		
Silk-oak	1,873	--	219	505	483	333	333	--	--		
Tropical ash	1,236	--	40	105	176	220	514	181	--		
Other hardwoods ^{3/}	1,095	--	107	198	84	210	399	78	19		
Norfolk-Island-pine	899	--	70	198	292	280	59	--	--		
Other conifers ^{4/}	1,022	--	260	310	197	134	121	--	--		
Total	100,684	--	4,821	9,172	13,427	15,910	49,455	7,397	502		

Species group	Tree diameter class (inches at breast height)										
	All	5.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	25.0-	plus
: classes : 10.9 : 12.9 : 14.9 : 16.9 : 18.9 : 20.9 : 22.9 : 24.9 : 26.9 : 28.9 : 30.9											
----- Thousand cubic feet -----											
Robusta eucalyptus	14,599	788	1,099	1,492	1,944	2,102	6,231	875	68		
Saligna eucalyptus	2,281	64	105	132	194	277	1,324	179	6		
Other eucalypts ^{2/}	2,457	237	253	354	389	383	736	99	6		
Silk-oak	488	70	71	118	98	65	66	--	--		
Tropical ash	423	26	152	26	35	45	102	37	--		
Other hardwoods ^{3/}	343	107	34	45	17	44	78	14	4		
Norfolk-Island-pine	186	15	20	40	52	49	10	--	--		
Other conifers ^{4/}	593	319	103	82	43	25	21	--	--		
Total	21,370	1,626	1,837	2,289	2,772	2,990	8,568	1,204	84		

^{1/} International 1/4-inch rule.

^{2/} Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

^{3/} Includes ohia, koa, Molucca albizzia, jhalna, Australian redcedar, and Nepal alder.

^{4/} Includes sugi, western redcedar, Port-Orford-cedar, and redwood.

Table 12.--Volume of sawtimber and growing stock in planted sawtimber stands
by species group and tree diameter class in Kau Working Circle,
Island of Hawaii, 1965

Species group	Tree diameter class (inches at breast height)												plus
	All	5.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	25.0-	27.0-		
	classes	10.9	12.9	14.9	16.9	18.9	20.9	22.9	24.9	26.9	28.9		
-----Thousand board feet ^{1/} -----													
Robusta eucalyptus	6,108	--	277	787	936	1,265	2,474	369	--	--	--	--	--
Saligna eucalyptus	552	--	19	25	20	32	359	97	--	--	--	--	--
Other eucalypts ^{2/}	201	--	19	26	10	48	96	2	--	--	--	--	--
Silk-oak	224	--	32	24	28	78	62	--	--	--	--	--	--
Other hardwoods ^{3/}	4	--	--	4	--	--	--	--	--	--	--	--	--
Norfolk-Island-pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	7,089	--	347	866	994	1,423	2,991	468	--	--	--	--	--
-----Thousand cubic feet-----													
Robusta eucalyptus	1,324	60	103	213	200	243	443	62	--	--	--	--	--
Saligna eucalyptus	133	18	12	11	5	8	62	17	--	--	--	--	--
Other eucalypts ^{2/}	46	1	9	6	3	9	18	--	--	--	--	--	--
Silk-oak	62	13	10	6	6	15	12	--	--	--	--	--	--
Other hardwoods ^{3/}	3	1	--	2	--	--	--	--	--	--	--	--	--
Norfolk-Island-pine	2	2	--	--	--	--	--	--	--	--	--	--	--
Total	1,570	95	134	238	214	275	535	79	--	--	--	--	--

^{1/} International 1/4-inch rule.

^{2/} Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

^{3/} Includes ohia and Australian redcedar.

Table 14.--Volume of sawtimber and growing stock in planted sawtimber stands by species group and tree diameter class in Kohala Working Circle, Island of Hawaii, 1965

[illegible]

1/ International 1/4-inch rule.

2/ Mainly *Eucalyptus* spp. but includes brushbox.

3/ Includes ohia, Molucca albizzia, and ihalna.

4/ Includes sugi and other commercial conifers.

Table 15.-Sawtimber volume in planted sawtimber stands in
Hilo-Hamakua Working Circle by ownership class,
species group, and log grade,^{1/} Island of Hawaii,
1965

Ownership class and species group	All grades	Factory Grade 1	lumber Grade 2	logs Grade 3	Tie and timber logs Grade 4	Softwood species ^{2/}
----- Thousand board feet ^{3/} -----						
<u>State</u>						
Robusta eucalyptus	35,117	8,056	8,025	8,011	11,025	--
Saligna eucalyptus	9,212	4,406	1,981	1,551	1,274	--
Other eucalypts ^{4/}	8,902	1,842	2,329	2,197	2,534	--
Silk-oak	1,873	26	400	591	856	--
Tropical ash	1,018	167	277	359	215	--
Other hardwoods ^{5/}	923	73	147	202	501	--
Commercial conifers ^{6/}	797	--	--	--	--	797
Total	57,842	14,570	13,159	12,911	16,405	797
<u>Hawaiian Homes</u>						
Robusta eucalyptus	12,558	2,423	2,877	3,053	4,205	--
Saligna eucalyptus	2,706	1,327	640	490	249	--
Other eucalypts ^{4/}	549	--	112	152	285	--
Tropical ash	9	--	--	3	6	--
Other hardwoods ^{5/}	23	--	11	9	3	--
Commercial conifers ^{6/}	180	--	--	--	--	180
Total	16,025	3,750	3,640	3,707	4,748	180
<u>Private</u>						
Robusta eucalyptus	22,836	6,827	5,108	4,564	6,337	--
Saligna eucalyptus	1,421	454	386	308	273	--
Other eucalypts ^{4/}	1,258	76	247	407	528	--
Tropical ash	209	29	39	69	72	--
Other hardwoods ^{5/}	149	10	25	20	94	--
Norfolk-Island-pine	899	--	--	--	--	899
Other conifers ^{6/}	45	--	--	--	--	45
Total	26,817	7,396	5,805	5,368	7,304	944
<u>All Ownerships</u>						
Robusta eucalyptus	70,511	17,306	16,010	15,628	21,567	--
Saligna eucalyptus	13,339	6,187	3,007	2,349	1,796	--
Other eucalypts ^{4/}	10,709	1,918	2,688	2,756	3,347	--
Silk-oak	1,873	26	400	591	856	--
Tropical ash	1,236	196	316	431	293	--
Other hardwoods ^{5/}	1,095	83	183	231	598	--
Norfolk-Island-pine	899	--	--	--	--	899
Other conifers ^{6/}	1,022	--	--	--	--	1,022
Total	100,684	25,716	22,604	21,986	28,457	1,921

^{1/} Based on standard specifications for hardwood log grades for standard
lumber.

^{2/} Commercial conifer species are not log-graded.

^{3/} International 1/4-inch rule.

^{4/} Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

^{5/} Includes ohia, koa, Molucca albizzia, jhalna, Australian redcedar, and
Nepal alder.

^{6/} Includes sugi, western redcedar, Port-Orford-cedar, and redwood.

Table 16.--Sawtimber volume in planted sawtimber stands in
Kau Working Circle by ownership class, species
group, and log grade,^{1/} Island of Hawaii, 1965

Ownership class and species group ^{2/}	:	:	:	:	Tie and timber logs
	:	All	:	Factory lumber logs	:
	:	grades	:	Grade 1: Grade 2: Grade 3: Grade 4	:
				----- Thousand board feet ^{3/} -----	
<u>State</u>					
Robusta eucalyptus	3,444	571	516	955	1,402
Saligna eucalyptus	530	203	173	76	78
Other eucalypts ^{4/}	121	15	17	40	49
Silk-oak	97	--	16	41	40
Other hardwoods ^{5/}	4	--	--	4	--
Total	4,196	789	722	1,116	1,569
<u>Hawaiian Homes</u>					
	--	--	--	--	--
<u>Private</u>					
Robusta eucalyptus	2,664	627	543	711	783
Saligna eucalyptus	22	10	8	--	4
Other eucalypts ^{4/}	80	33	9	19	19
Silk-oak	127	6	43	53	25
Total	2,893	676	603	783	831
<u>All Ownerships</u>					
Robusta eucalyptus	6,108	1,198	1,059	1,666	2,185
Saligna eucalyptus	552	213	181	76	82
Other eucalypts ^{4/}	201	48	26	59	68
Silk-oak	224	6	59	94	65
Other hardwoods ^{5/}	4	--	--	4	--
Total	7,089	1,465	1,325	1,899	2,400

^{1/} Based on standard specifications for hardwood log grades for standard lumber.

^{2/} No conifer sawtimber tallied in Kau Working Circle.

^{3/} International 1/4-inch rule.

^{4/} Mainly Eucalyptus spp. but includes brushbox and turpentine-tree.

^{5/} Includes ohia and Australian redcedar.

Table 17.--Sawtimber volume in planted sawtimber stands in Kona Working Circle by ownership class, species group, and log grade,^{1/} Island of Hawaii, 1965

	:	:		:	Tie and	:
Ownership class and	:	All	:	Factory lumber logs	:	timber logs:Softwood
species group	:	grades	:	Grade 1:Grade 2:Grade 3:	Grade 4	:species ^{2/}
	----- Thousand board feet ^{3/} -----					
<u>State</u>						
Robusta eucalyptus	1,124	232	238	245	409	--
Other eucalypts ^{4/}	1,024	--	15	184	825	--
Silk-oak	98	--	40	22	36	--
Tropical ash	86	--	31	21	34	--
Other hardwoods ^{5/}	10	2	--	8	--	--
Commercial conifers ^{6/}	165	--	--	--	--	165
Total	2,507	234	324	480	1,304	165
<u>Hawaiian Homes</u>						
	--	--	--	--	--	--
<u>Private</u>						
Robusta eucalyptus	184	2	28	24	130	--
Other eucalypts ^{4/}	105	6	12	32	55	--
Silk-oak	996	--	59	386	551	--
Tropical ash	9	1	2	2	4	--
Other hardwoods ^{5/}	1	--	--	--	1	--
Commercial conifers ^{6/}	66	--	--	--	--	66
Total	1,361	9	101	444	741	66
<u>All Ownerships</u>						
Robusta eucalyptus	1,308	234	266	269	539	--
Other eucalypts ^{4/}	1,129	6	27	216	880	--
Silk-oak	1,094	--	99	408	587	--
Tropical ash	95	1	33	23	38	--
Other hardwoods ^{5/}	11	2	--	8	1	--
Commercial conifers ^{6/}	231	--	--	--	--	231
Total	3,868	243	425	924	2,045	231

^{1/} Based on standard specifications for hardwood log grades for standard lumber.

^{2/} All commercial conifer species are not log graded.

^{3/} International 1/4-inch rule.

^{4/} All commercial Eucalyptus spp. except Eucalyptus robusta.

^{5/} Includes ohia and koa.

^{6/} Includes sugi, western redcedar, Port-Orford-cedar, and redwood.

Table 18.--Sawtimber volume in planted sawtimber stands in Kohala Working Circle by ownership class, species group, and log grade,^{1/} Island of Hawaii, 1965

	: All	: <u>Factory lumber logs</u>	: <u>timber logs</u>	: Tie and	: <u>Softwood</u>	
Ownership class and species group	: grades	: Grade 1:	Grade 2:	Grade 3:	Grade 4	: species ^{2/}
	----- <u>Thousand board feet</u> ^{3/} -----					
<u>State</u>						
Robusta eucalyptus	378	27	17	52	282	--
Other eucalypts ^{4/}	36	3	5	9	19	--
Total	414	30	22	61	301	--
<u>Hawaiian Homes</u>						
Robusta eucalyptus	261	27	36	75	123	--
Norfolk-Island-pine	69	--	--	--	--	69
Other conifers ^{6/}	32	--	--	--	--	32
Total	362	27	36	75	123	101
<u>Private</u>						
Robusta eucalyptus	2,107	147	285	547	1,128	--
Saligna eucalyptus	4	--	1	2	1	--
Other eucalypts ^{4/}	653	121	169	150	213	--
Other hardwoods ^{5/}	1,263	679	319	152	113	--
Norfolk-Island-pine	391	--	--	--	--	391
Other conifers ^{6/}	8	--	--	--	--	8
Total	4,426	947	774	851	1,455	399
<u>All Ownerships</u>						
Robusta eucalyptus	2,746	201	338	674	1,533	--
Saligna eucalyptus	4	--	1	2	1	--
Other eucalypts ^{4/}	689	124	174	159	232	--
Other hardwoods ^{5/}	1,263	679	319	152	113	--
Norfolk-Island-pine	460	--	--	--	--	460
Other conifers ^{6/}	40	--	--	--	--	40
Total	5,202	1,004	832	987	1,879	500

^{1/} Based on standard specifications for hardwood log grades for standard lumber.

^{2/} All commercial conifer species are not log graded.

^{3/} International 1/4-inch rule.

^{4/} Mainly Eucalyptus spp. but includes brushbox.

^{5/} Includes ohia, Molucca albizzia, and jhalna.

^{6/} Includes sugi and other commercial conifers.

Table 19.--Listing of individual stands and plantings with
species type, ownership, area, and volume,
Island of Hawaii, 1965

Stand no.	Species type	Owner ^{1/}	Acres	Total stand volume <u>Thousand board feet</u>
8001	Robusta eucalyptus	223	119	1,007
8002	Ironwood	223	45	-- ^{2/}
8003	Robusta eucalyptus	112	37	470
8004	" "	223	84	1,014
8005	" "	112	230	1,543
8006	Robusta eucalyptus	112	245	3,391
8007	" "	112	56	703
8008	" "	112	16	107
8009	" "	112	85	1,211
8010	" "	322	46	929
8011	Robusta eucalyptus	243	48	1,063
8012	" "	241	90	2,831
8013	" "	241	154	3,274
8014	" "	241	45	927
8015	" "	241	45	671
8016	Robusta eucalyptus	241	10	140
8017	" "	112	60	414
8018	" "	243	26	473
8019	" "	241	10	211
8020	" "	243	9	158
8021	Tropical ash	112	63	849
8022	Mixed eucalyptus	225	67	210
8023	Tropical ash	112	16	116
8024	Silk-oak	112	24	114
8025	Robusta eucalyptus	112	60	1,123

^{1/} Code numbers in this column identify landowners as State (112), lands under jurisdiction of Hawaiian Homes Commission (111), and private owners (all other numbers).

Ownership of plantation stands is based on interpretation of locations on Tax-Key maps and topographic maps which are often inadequate for precise determinations. Therefore, for a given plantation stand the ownership designation may be in error, although overall ownership statistics are probably not greatly affected by this kind of error.

^{2/} -- indicates noncommercial plantation type throughout table.

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume <u>Thousand</u> <u>board feet</u>
8026	Robusta eucalyptus	112	50	2,010
8027	Lemon eucalyptus	225	10	114
8028	Ironwood	225	3	--
8029	Norfolk-Island-pine	225	33	899
8030	Robusta eucalyptus	225	34	647
8031	Ironwood	225	6	--
8032	Robusta eucalyptus	225	51	1,815
8033	Tropical ash	225	15	29
8034	" "	248	11	167
8035	Robusta eucalyptus	112	42	417
8036	Mixed eucalyptus	112	23	112
8037	" "	112	10	13
8038	Robusta eucalyptus	111	210	5,402
8039	Saligna eucalyptus	111	16	555
8040	Robusta eucalyptus	111	19	219
8041	Mixed eucalyptus	112	111	2,566
8042	Saligna eucalyptus	112	21	780
8043	Robusta eucalyptus	112	214	3,937
8044	" "	111	200	3,377
8045	" "	111	12	305
8046	Robusta eucalyptus	111	32	714
8047	" "	111	28	361
8048	" "	111	116	1,929
8049	Mixed eucalyptus	111	140	1,975
8050	Paper-bark	111	4	--
8051	Tropical ash	111	5	9
8052	Brushbox	111	7	8
8053	Mixed eucalyptus	111	15	16
8054	Monterey cypress	111	12	--
8055	Robusta eucalyptus	248	3	63
8056	Mixed eucalyptus	112	67	657
8057	Brushbox	112	20	426
8058	Robusta eucalyptus	112	60	1,281
8059	Mixed eucalyptus	112	14	118
8060	Robusta eucalyptus	112	18	434

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume Thousand board feet
8061	Robusta eucalyptus	225	18	483
8062	" "	324	11	343
8063	" "	324	3	93
8064	" "	323	45	843
8065	" "	225	47	642
8066	Lemon eucalyptus	225	11	14
8067	Mixed eucalyptus	112	83	1,686
8068	Silk-oak	112	60	981
8069	Mixed eucalyptus	112	36	754
8070	Saligna eucalyptus	112	13	490
8071	Mixed eucalyptus	112	39	1,309
8072	Mixed species	112	58	910
8073	" "	112	8	274
8074	Tallowwood eucalyptus	112	8	350
8075	Robusta eucalyptus	112	24	604
8076	Silk-oak	112	36	622
8077	Mixed species	112	69	1,705
8078	Bluegum eucalyptus	112	230	--
8079	" "	112	140	--
8080	" "	112	26	--
8081	Bluegum eucalyptus	112	413	--
8082	" "	112	72	--
8083	Robusta eucalyptus	217	4	137
8084	Mixed eucalyptus	217	27	482
8085	Bluegum eucalyptus	112	40	--
8086	Bluegum eucalyptus	112	120	--
8087	" "	303	50	--
8088	" "	303	60	--
8089	" "	217	3	--
8090	" "	217	3	--
8091	Bluegum eucalyptus	217	4	--
8092	" "	217	38	--
8093	Robusta eucalyptus	112	28	711
8094	" "	112	51	1,800
8095	Mixed eucalyptus	112	23	309

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume <u>Thousand board feet</u>
8096	Robusta eucalyptus	112	15	388
8097	Mixed eucalyptus	112	12	463
8098	Saligna eucalyptus	112	21	1,012
8099	Mixed eucalyptus	217	6	123
8100	Robusta eucalyptus	242	3	38
8101	Saligna eucalyptus	242	3	62
8102	Mixed eucalyptus	242	3	61
8103	" "	248	9	48
8104	" "	248	11	197
8105	" "	248	10	81
8106	Mixed eucalyptus	248	10	65
8107	Robusta eucalyptus	248	59	991
8108	" "	248	83	324
8109	Saligna eucalyptus	111	11	57
8110	Robusta eucalyptus	112	89	2,118
8111	Paper-bark	248	7	--
8112	Sugi	248	3	* <u>3/</u>
8113	Paper-bark	248	3	--
8114	Sugi	248	5	4
8115	Robusta eucalyptus	248	10	254
8116	Robusta eucalyptus	112	58	460
8117	" "	204	26	249
8118	Bluegum eucalyptus	204	21	--
8119	Mixed species	112	23	222
8120	" "	112	65	424
8121	Sugi	112	110	620
8122	Robusta eucalyptus	112	88	2,157
8123	" "	112	102	1,837
8124	" "	223	8	207
8125	" "	223	78	1,316
8126	Robusta eucalyptus	112	34	450
8127	" "	112	6	29
8128	Sugi	112	86	39
8129	Robusta eucalyptus	248	5	5
8130	Mixed eucalyptus	112	2	41

3/ * indicates poletimber or seedling and sapling stands throughout table.

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume <u>Thousand board feet</u>
8131	Robusta eucalyptus	112	138	2,208
8132	" "	241	5	43
8133	Paper-bark	241	8	--
8134	Robusta eucalyptus	112	40	603
8135	Nepal alder	112	7	64
8136	Robusta eucalyptus	112	9	30
8137	Silk-oak	112	11	94
8138	Robusta eucalyptus	112	70	412
8139	" "	223	22	536
8140	Nepal alder	112	6	58
8141	Nepal alder	112	16	175
8142	Robusta eucalyptus	243	5	61
8143	" "	112	40	939
8144	" "	243	8	237
8145	Saligna eucalyptus	243	5	62
8146	Robusta eucalyptus	112	9	717
8147	" "	241	7	201
8148	Sugi	243	22	9
8149	Robusta eucalyptus	112	27	539
8150	Paper-bark	112	8	--
8151	Robusta eucalyptus	112	26	149
8152	Sugi	111	3	59
8153	Paper-bark	243	7	--
8154	Robusta eucalyptus	111	67	912
8155	Sugi	111	36	129
8156	Paper-bark	241	7	--
8157	Robusta eucalyptus	112	3	14
8158	Nepal alder	112	8	116
8159	" "	112	11	46
8160	" "	112	2	19
8161	Nepal alder	112	2	18
8162	Mixed eucalyptus	112	18	693
8163	Saligna eucalyptus	225	3	41
8164	Mixed species	225	4	63
8165	" "	112	41	173

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume Thousand board feet
8166	Tropical ash	112	7	99
8167	Robusta eucalyptus	112	13	375
8168	Tallowwood eucalyptus	112	7	231
8169	Mixed eucalyptus	112	31	341
8170	Saligna eucalyptus	217	17	905
8171	Mixed eucalyptus	112	10	159
8172	Silk-oak	112	5	50
8173	Robusta eucalyptus	217	9	227
8174	Mixed eucalyptus	112	9	122
8175	Ironwood	112	22	--
8176	Bluegum eucalyptus	248	5	--
8177	Saligna eucalyptus	112	15	632
8178	Mixed eucalyptus	112	50	980
8179	Ironwood	112	18	--
8180	Saligna eucalyptus	112	21	1,389
8181	Norfolk-Island-pine	111	2	*
8182	Tropical ash	248	4	56
8183	Robusta eucalyptus	112	23	471
8184	Mixed eucalyptus	112	8	228
8185	Robusta eucalyptus	248	29	723
8186	Tallowwood eucalyptus	112	2	88
8187	Ironwood	112	23	--
8201	Saligna eucalyptus	112	45	322
8202	Mixed eucalyptus	112	70	752
8203	Silk-oak	112	6	*
8204	Robusta eucalyptus	112	33	247
8205	" "	326	4	10
8206	" "	226	10	115
8207	" "	226	3	34
8208	Bluegum eucalyptus	226	7	--
8209	Ironwood	226	11	--
8210	Silk-oak	219	2	17
8211	Robusta eucalyptus	219	69	557
8212	" "	226	9	32
8213	" "	112	7	138

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume Thousand board feet
8214	Robusta eucalyptus	112	11	87
8215	Ironwood	112	31	--
8216	Robusta eucalyptus	112	33	303
8217	" "	112	18	350
8218	Bluegum eucalyptus	219	3	--
8219	Robusta eucalyptus	112	69	899
8220	Bluegum eucalyptus	112	4	--
8221	Robusta eucalyptus	112	30	498
8222	" "	112	28	269
8223	" "	112	15	47
8224	Robusta eucalyptus	112	31	82
8225	" "	112	9	123
8226	Silk-oak	219	4	19
8227	" "	112	4	34
8228	Mixed species	219	27	118
8229	Bluegum eucalyptus	326	4	--
8230	Silk-oak	219	4	34
8231	Robusta eucalyptus	219	27	157
8232	" "	219	34	888
8233	" "	219	6	52
8234	Robusta eucalyptus	219	9	163
8235	" "	219	9	323
8236	Bluegum eucalyptus	112	3	--
8237	Robusta eucalyptus	219	115	303
8238	" "	219	3	26
8239	Robusta eucalyptus	219	5	56
8240	Silk-oak	112	4	34
8301	Mixed eucalyptus	248	9	--
8302	" "	248	8	--
8303	Saligna eucalyptus	248	11	--
8304	Mixed eucalyptus	248	16	--
8305	" "	248	9	--
8306	" "	248	42	--
8307	" "	248	3	--
8308	" "	248	60	--

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume <u>Thousand</u> <u>board feet</u>
8309	Mixed eucalyptus	248	58	--
8310	" "	248	60	--
8311	" "	248	9	--
8312	" "	248	6	--
8313	" "	248	2	--
8314	Mixed eucalyptus	248	3	--
8315	" "	248	2	--
8316	Robusta eucalyptus	248	6	--
8317	Mixed eucalyptus	248	50	--
8318	" "	248	12	--
8319	Mixed eucalyptus	248	12	--
8320	" "	248	13	--
8321	" "	248	11	--
8322	" "	112	2	--
8323	" "	248	2	--
8324	Mixed eucalyptus	248	2	--
8325	" "	248	10	--
8326	" "	248	14	--
8327	" "	248	9	--
8328	" "	248	11	--
8329	Mixed eucalyptus	248	3	--
8330	" "	248	11	--
8331	" "	248	10	--
8332	" conifers	112	41	*
8333	" eucalyptus	112	103	863
8334	Mixed eucalyptus	112	40	161
8335	Robusta eucalyptus	112	3	22
8336	Robusta eucalyptus	112	3	25
8337	Mixed eucalyptus	211	4	30
8338	Mixed species	211	3	9
8339	Mixed eucalyptus	213	2	15
8340	Robusta eucalyptus	213	3	23
8341	Sugi	213	3	22
8342	"	213	6	44
8343	Tropical ash	112	25	73

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume <u>Thousand board feet</u>
8344	Robusta eucalyptus	112	148	1,108
8345	Silk-oak	249	91	986
8346	Silk-oak	112	22	98
8347	Robusta eucalyptus	204	46	216
8348	Mixed eucalyptus	211	2	15
8349	Mixed eucalyptus	248	2	--
8350	" "	111	35	--
8351	Sugi	112	8	158
8401	Lemon eucalyptus	325	6	212
8402	Norfolk-Island-pine	325	5	97
8403	Jhalna	231	6	97
8404	Ironwood	231	5	--
8405	"	231	7	--
8406	"	231	3	--
8407	"	231	5	--
8408	Ironwood	231	3	--
8409	Robusta eucalyptus	231	4	89
8410	Ironwood	231	5	--
8411	"	231	6	--
8412	Robusta eucalyptus	231	16	319
8413	Mixed eucalyptus	325	6	187
8414	Ironwood	325	33	--
8415	"	325	15	--
8416	Mixed eucalyptus	231	3	60
8417	Ironwood	231	4	--
8418	Ironwood	231	4	--
8419	"	231	4	--
8420	"	231	4	--
8421	"	231	3	--
8422	"	231	15	--
8423	Ironwood	231	10	--
8424	Norfolk-Island-pine	231	13	292
8425	Robusta eucalyptus	231	7	64
8426	" "	231	10	246
8427	" "	231	8	257

Table 19, continued

Stand no.	Species type	Owner	Acres	Total stand volume Thousand board feet
8428	Robusta eucalyptus	231	5	115
8429	" "	231	4	80
8430	Mixed eucalyptus	231	2	40
8431	Robusta eucalyptus	231	5	90
8432	Ironwood	231	20	--
8433	Ironwood	231	28	--
8434	Jhalna	231	3	49
8435	Molucca albizzia	231	32	218
8436	" "	231	27	761
8437	Robusta eucalyptus	231	20	619
8438	Robusta eucalyptus	231	5	111
8439	" "	231	3	93
8440	Mixed eucalyptus	231	4	72
8441	Ironwood	227	4	--
8442	Paper-bark	248	11	--
8443	Tropical ash	248	9	*
8444	Robusta eucalyptus	112	33	378
8445	" "	111	5	71
8446	" "	111	3	60
8447	" "	111	5	72
8448	Sugi	111	5	32
8449	Ironwood	111	16	--
8450	Robusta eucalyptus	111	5	60
8451	Mixed eucalyptus	112	4	36
8452	" "	231	4	46
8453	Jhalna	231	4	65
8454	Robusta eucalyptus	231	3	66
8455	Norfolk-Island-pine	111	3	64
8456	Molucca albizzia	231	3	84
8457	Paper-bark	248	5	--
Total Forest Plantation (prior to 1957)			9,711	116,843

Table 19, continued

Species type	:	Owner	:	Acres	:	Total stand volume
<hr/>						
<u>Waiakea area</u> ^{4/}						
Australian redcedar		112		1,859		*
Tropical ash		112		932		*
Australian redcedar-tropical ash		112		1,500		*
Australian redcedar-Spanish cedar		112		25		*
Mixed hardwood spp.		112		74		*
Eucalyptus spp.		112		35		*
<hr/>						
Total Waiakea				4,425		
<hr/>						
<u>Honaunau area</u> ^{4/}						
Australian redcedar		204		868		*
Tropical ash		204		387		*
Spanish cedar		204		66		*
Eucalyptus-Australian redcedar		204		60		*
Eucalyptus spp.		204		9		*
<hr/>						
Total Honaunau				1,390		
<hr/>						
Total reforestation area				5,815		
<hr/>						
Total all forest plantations				15,526		
<hr/>						

^{4/} Areas reforested between 1957-1965; no stand numbers assigned.

Table 20.--Identity of individual plantation stands in the groups shown on the map "Forest Plantations on the Island of Hawaii--1965"^{1/}

Group: stand: no. :		::Group: ::stand: :: no. :	
	Individual stand no.		Individual stand no.
1	8126, 49-51	31	8154-55, 63-64
2	8134, 37-38	32	8022-25, 33
3	8001-02, 8124-25	33	8026-32
4	8007, 8122-23, 36, 67	34	8110
5	8005-06	35	8135, 40-41, 59-61
6	8004, 8139	36	8107-09, 58, 81, 85
7	8014-16	37	8127-30, 57
8	8012-13, 19-20, 8153, 56	38	8442-50, 55, 57
9	8008-11, 17-18, 8142-48, 83	39	8441
10	8131-33	40	8403, 09, 33-40, 52-54, 56
11	8165	41	8424-31, 51
12	8021	42	8401-02, 10-23, 32
13	8121	43	8404-08
14	8085-86, 88, 8116-20	44	8301-03, 12-16, 30-31, 50
15	8093-98, 8162, 71-72, 74-75, 77-80	45	8304-11, 22
16	8170, 73	46	8317-21, 23-29, 49
17	8168-69	47	8346
18	8083-84, 99	48	8345
19	8087, 89-92	49	8344
20	8078-82	50	8322-38, 43, 47-48, 51
21	8103-06, 8111-12, 76	51	8339-42
22	8100-02	52	8201-06, 29
23	8067-77, 8166, 86	53	8206-09, 12
24	8044-49, 8113-15	54	8213-17, 19, 21-25
25	8056-61, 8184	55	8210, 26, 28
26	8062-66	56	8218, 32-35
27	8003, 35-37, 50-53	57	8211, 30-31, 37-39
28	8034, 54-55, 8152, 82	58	8220, 27, 36, 40
29	8041-43, 8187		
30	8038-40		

^{1/} Unnumbered stands on the map are identified by symbols as follows:

WRP--Waiakea reforestation planting, 1957-65; includes seedling, sapling, and pole timber.

HRP--Honaunau reforestation planting, 1957-65; includes seedling, sapling, and pole timber.

WA--Waiakea Arboretum.

HEXP--Honaunau experimental planting.



